Elizabeth Newman | Curriculum Vitae

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Professional Experience

Emory University Department of Mathematics — Atlanta, GA

Distinguished Visiting Assistant Professor in Scientific Computing — June 2019 – Present

Spelman-Morehouse Directed Reading Program — Virtual

Mentor — Fall 2021

Work one-on-one with an undergraduate student on an independent reading project covering math not typically taught in an undergraduate-level class.

Project: *Don't Trust Neural Networks*

Emory University NSF REU/RET Computational Mathematics for Data Science — Atlanta, GA

Executive Board Member — Summer 2021

Responsibilities included designing the REU/RET schedule, deliverables, and website, organizing tutorials, seminars, and professional development opportunities, and facilitating connections in the remote setting.

Project Advisor — Summer 2021

Project: *A Tensor SVD-based Classification Algorithm Applied to fMRI Data*

IBM TJ Watson Research Center — Yorktown, NY

Visiting Scholar — Summer 2017, 2018

Tufts University Department of Mathematics — Medford, MA

Teaching and Research Assistant — August 2014 – May 2019

Education

Tufts University — Medford, MA

Ph.D. in Mathematics — May 2019

M.S. in Mathematics — May 2016

Haverford College — Haverford, PA

Bachelor of Science in Mathematics and Statistics — May 2014

Member, varsity women's soccer and softball teams. Centennial Conference Honor Roll all years.

Research Interests

Numerical linear algebra and multilinear algebra, machine learning, deep neural networks, scientific computing, image classification and recognition, optimization

Publications

Elizabeth Newman, Julianne Chung, Matthias Chung, and Lars Ruthotto. `slimTrain` – *A Stochastic Approximation Method for Training Separable Deep Neural Networks*. Submitted to SISC, October 2021. Available on arXiv:2109.14002.

Misha Kilmer, Lior Horesh, Haim Avron and Elizabeth Newman. *Tensor-Tensor Algebra for Optimal Representation and Compression of Multiway Data*. PNAS, 118(28), July 2021. Available at pnas.2015851118 and related version on arXiv:2001.00046.

Elizabeth Newman, Lars Ruthotto, Joseph Hart, and Bart van Bloemen Waanders. *Train Like a (Var)Pro: Efficient Training of Neural Networks with Variable Projection*. Accepted to SIMODS, June 2021. Available on arXiv:2007.13171.

Elizabeth Newman and Misha Kilmer. *Non-negative tensor patch dictionary approaches for image compression and deblurring applications*. Accepted to SIIMS, April 2020. Available on arXiv:1910.00993.

Elizabeth Newman. *A Step in the Right Dimension: Tensor Algebra and Applications*. Dissertation.

Elizabeth Newman, Lior Horesh, Haim Avron, Misha Kilmer. *Stable tensor neural networks for rapid deep learning*. Available on arXiv:1811.06569.

Elizabeth Newman, Misha Kilmer, Lior Horesh. *Image classification using local tensor singular value decompositions*. IEEE CAMSAP, 2017 (DOI:10.1109/CAMSAP.2017.8313137). Available on arXiv:1706.09693.

Patents

Kilmer (Tufts), Horesh (IBM), Avron (Tel Aviv), Newman (Tufts). *System and method for optimal multi-dimensional data compression by tensor-tensor decompositions*. Patent reference P201807026US01, filed 2019.

Newman (Tufts), Horesh (IBM), Avron (Tel Aviv), Kilmer (Tufts). *Generating and managing deep tensor neural networks*. Patent reference P201803885US01, filed 2018.

Conferences and Workshops

Workshops:

ICCV 2021 Workshop on Topology, Algebra and Geometry in Computer Vision — October 2021

Program Committee Member

Minisymposium Organizer:

SIAM Annual Meeting — July 2020

"A Deep Look at Neural Networks with Applications in Scientific Machine Learning."

Accepted, but not held due to COVID-19 pandemic.

Travel Awards:

SIAM Student Travel Award

SIAM Conference on Computational Science and Engineering — February 2019

SIAM Conference on Applied Linear Algebra — May 2018

Graduate Student Travel Fund from Tufts University

SIAM Conference on Computational Science and Engineering — February 2019

SIAM Conference on Imaging Science — June 2018

Invited talks:

Computational and Applied Mathematics Seminar — UNC Charlotte, November 2021

Applied Numerical Analysis Seminar — Virginia Tech, October 2021

Communications in NLA — Virtual, November 2020

Bi-College Colloquium — Haverford College/Bryn Mawr College, December 2019

Scientific Computing Seminar — Emory University, September 2019

Schlumberger Doll Research — Cambridge, MA, May 2019

SIAM Student Chapter — Tufts University, September 2018

IBM TJ Watson Research Center — Yorktown, NY, August 2018

Computational and Applied Math Seminar — Tufts University, March 2018

Conferences:

Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering, and Technology — September 2021

SIAM Conference on Optimization — July 2021

SIAM Annual Meeting — July 2021

SAMSI Workshop on Numerical Analysis for Data Science — May 2021

SIAM Conference on Computational Science and Engineering — March 2021

SIAM Conference on Computational Science and Engineering — March 2021

Georgia Scientific Computing Symposium — February 2021

BIRS Workshop: Optimization under Uncertainty: Learning and Decision Making (Online) (21w5167) (recording) — Februray 2021

NLA Communications (recording) — November 2020

SIAM Conference on Imaging Science — July 2020

SIAM Conference on Mathematics of Data Science — May 2020

SIAM Southeastern Atlantic Section — September, 2019

SIAM Conference on Computational Science and Engineering — February 2019

SIAM Conference on Imaging Science — June 2018

SIAM Conference on Applied Linear Algebra — May 2018

15^{th} Copper Mountain Conference On Iterative Methods — March 2018

SIAM Annual Meeting — July 2016

Teaching Experience

Awards:

Distinguished Teaching Prize, Tufts Department of Mathematics — Tufts University, 2016/2017

Primary Instructor:

MATH347 Introduction to Nonlinear Optimization — Emory University, Fall 2021

MATH347 Introduction to Nonlinear Optimization — Emory University, Spring 2021

MATH221 Linear Algebra — Emory University, Fall 2020

MATH221 Linear Algebra — Emory University, Spring 2020

MATH221 Linear Algebra — Emory University, Fall 2019

MATH0034 Calculus II — Tufts University, Spring 2016

Teaching Assistant:

MATH0128 Numerical Linear Algebra — Tufts University, Spring 2019

MATH0126 Numerical Analysis — Tufts University, Fall 2018

MATH0042 Calculus III — Tufts University, Spring 2018

MATH0034 Calculus II — Tufts University, Fall 2017

MATH0019 Math of Social Choice — Tufts University, Fall 2015

MATH0136 Analysis II — Tufts University, Spring 2015

MATH0135 Analysis I — Tufts University, Fall 2014

Mentoring and Advising

Jonathan Vaylou, Emory University, expected May 2022 — Fall 2020 – Present

Emory Honors Program — Summer 2021 – Present

Scholarly Inquiry and Research Experience (SIRE) Program for Undergraduates — Fall 2020 – Spring 2021

Geoffrey Thorpe, Morehouse College, expected May 2022 — Fall 2021

Emory REU/RET Mentees — Summer 2021

Vida John, Tessellations School (high school teacher)

Katie Keegan, Mary Balwin, expected May 2022

Tanvi Vishwanath, Texas A&M, expected May 2023

Yihua Xu, Georgia Tech, expected May 2022

Emory Summer Research Experience Advisees (co-advised with Dr. Lars Ruthotto) — Summer 2019

Neeharika Kotte, Washington University in St. Louis, graduated May 2020

Haoruo Zhao, University of Wisconsin-Madison, graduated May 2020

Undergraduate Honors Thesis Committee Member (my own mentees listed above)

Ray Chen, Emory University, expected May 2022 — Fall 2021 – Spring 2022

Department of Neuroscience

Sophy Huang, Emory University, expected May 2022 — Fall 2021 – Spring 2022

Department of Computer Science

Service and Memberships

Service:

Emory University Postdoctoral Council for Diversity — Spring 2021 – Present

Member

Initiatives include organizing regular seminars on DEI themes such as creating inclusive classrooms and using data ethically, reaching out to local Atlanta schools to expose budding scholars to research in a variety of departments, and hosting professional development workshops for postdoctoral scholars.

Emory University Diversity, Equity, and Inclusion Committee — January 2021 – September 2021

Member of the Postdoctoral Subgroup

Part of a university-wide initiative to help develop and formalize DEI goals regarding climate and culture, professional development and education awareness, and accountability. Responsibilities include attending monthly meetings with postdoctoral scholars across departments and writing a formal recommendation to improve DEI with a postdoc-specific focus.

The Mathematical and Interdisciplinary Contest in Modeling

Faculty Advisor — Emory University, February 2021

SIAM Tufts University Student Chapter

President — Fall 2016 – Spring 2018

Responsibilities included networking with industry professionals to speak to our chapter. Speakers included professionals from large companies such as Microsoft, FactSet, and Optum, and smaller start-ups like CiBO and SessionM.

Vice President — Fall 2015 – Spring 2016

SIAM Tufts University Student Chapter — July 2015 – May 2016
Vice President

Tufts Graduate Student Council — Fall 2015 – Spring 2016
Treasurer

Tufts Organization of Graduate Students in Mathematics — Sept. 2014 – May 2015
First-year representative

Memberships:

Society for Industrial and Applied Mathematics (SIAM)
American Mathematical Society (AMS)
Association for Women in Mathematics (AWM)

Additional Volunteer Activities:

Biden Campaign — Fall 2020
Designed tools to predict incoming donations to the campaign based on upcoming events.

Fair Fight Action — Fall 2020 – Present
Served as a poll observer and phone and text banker for multiple elections at federal, state, and district levels.

Programming Skills

MATLAB, Python, Pytorch, Mathematica, R, LaTeX, Microsoft Office products